Developing Resources to Support AZCCRS Mathematics Implementation

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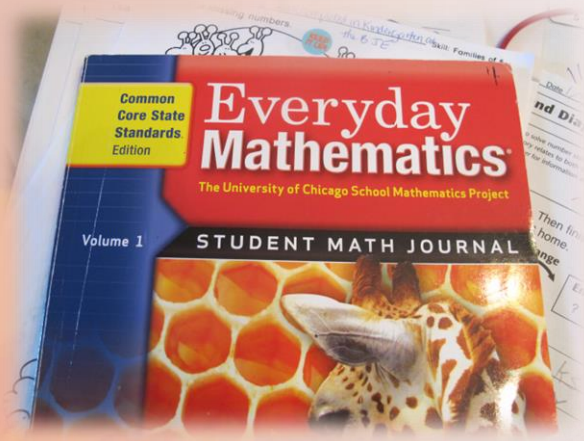
Who is our audience?

ARIZONA'S
COLLEGE AND CAREER READY STANDARDS


Prentice Hall
2013
Edition
MATHEMATICS
Common Core


Common
Core State
Standards
Edition
Everyday
Mathematics
The University of Chicago School Mathematics Project
Volume 1
STUDENT MATH JOURNAL


ALIGNED WITH
COMMON CORE
STATE STANDARDS


Common Core Lesson Plans
Kindergarten Math


Now
Common Core
Aligned!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Common
Core Aligned

- What process, if any, do you use in determining if your materials are aligned to the AZCCRS?

- What do you view as important when determining alignment?

ARIZONA'S
COLLEGE AND CAREER READY STANDARDS

What the Standards are Telling Us?

- Math Shifts
- Math Practices
- Math Content

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COLLEGE AND CAREER READY STANDARDS

Shift 1-FOCUS

- Focus strongly where the standards focus
- Significantly narrow the scope of content and deepen how time and energy is spent in the math classroom
- Focus deeply on what is emphasized in the standards, so that students gain strong foundations: inch-wide and mile-deep

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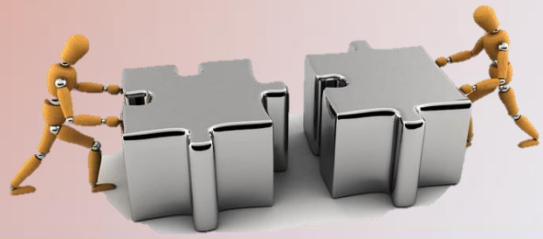
Shift 2-COHERENCE

- Think across grades, and link to major topics within grades
- Carefully connect the learning within and across grades so that students can build new understanding on foundations built in previous years
- Begin to count on solid conceptual understanding of core content and build on it. Each standard is not a new event, but an extension of previous learning



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Shift 3-RIGOR

- Requires a balance of:
  - Solid conceptual understanding
  - Procedural skill and fluency
  - Application of skills in problem solving situations

- Pursuit of all three requires equal intensity in time, activities, and resources

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Mathematical Practices

1. Make sense of problems and persevere in solving them
6. Attend to precision

2. Reason abstractly and quantitatively

3. Construct viable arguments and critique the reasoning of others

Reasoning and explaining

4. Model with mathematics

5. Use appropriate tools strategically

Modeling and using tools

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

Seeing structure and generalizing

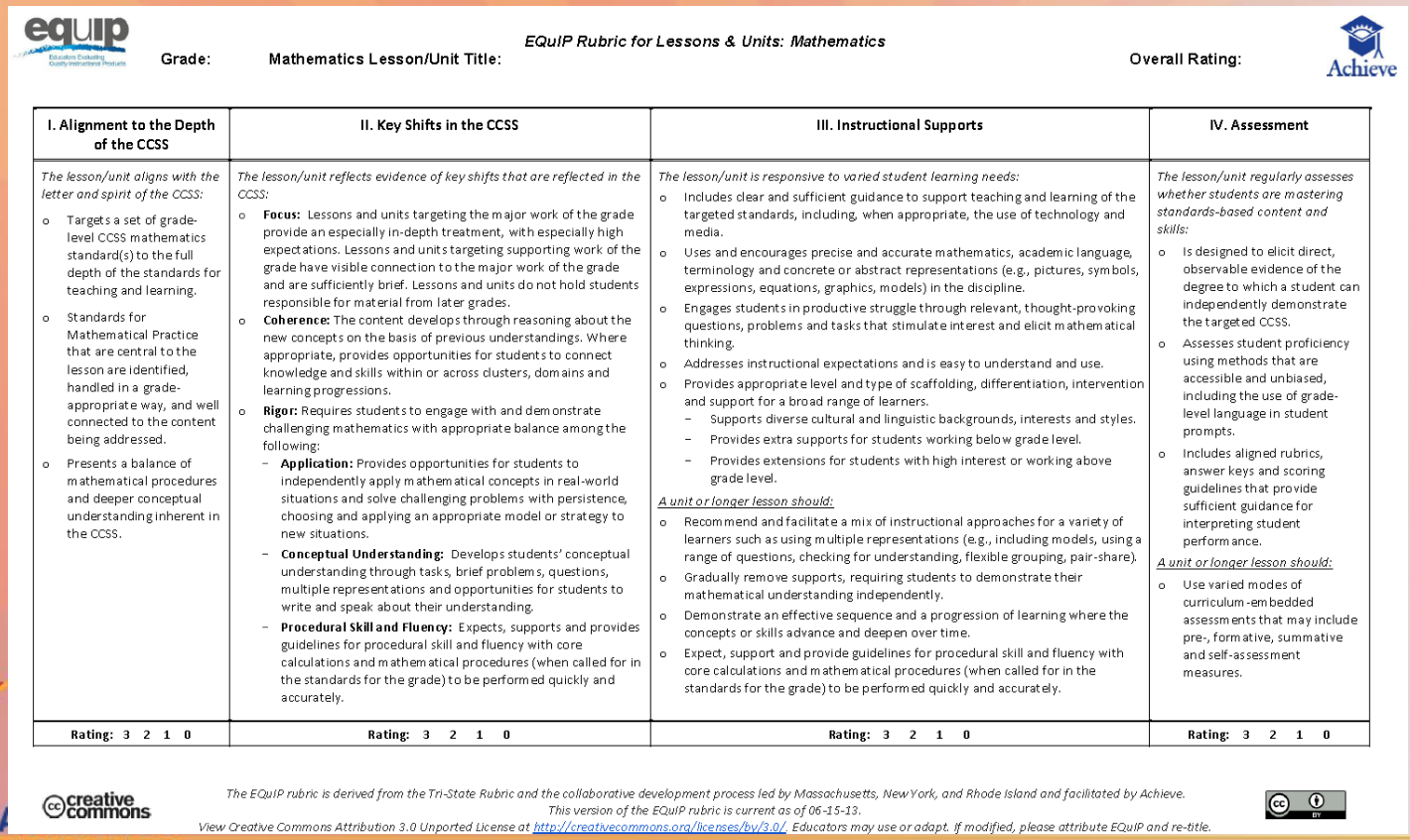
What the Standards are Telling Us?

- Math Shifts 
- Math Practices 
- Math Content 
  - Grade Level Standards
  - Cluster Headings
  - Previous and Future Grade-level standards/understandings

ARIZONA'S COLLEGE AND CAREER READY STANDARDS

Our Process

- Participated in Shifts/MP/Content trainings
- Participated in EQuIP training



EQuIP Rubric for Lessons & Units: Mathematics

Grade: Mathematics Lesson/Unit Title: Overall Rating:

I. Alignment to the Depth of the CCSS	II. Key Shifts in the CCSS	III. Instructional Supports	IV. Assessment
The lesson/unit aligns with the letter and spirit of the CCSS: o Targets a set of grade-level CCSS mathematics standard(s) to the full depth of the standards for teaching and learning. o Standards for Mathematical Practice that are central to the lesson are identified, handled in a grade-appropriate way, and well connected to the content being addressed. o Presents a balance of mathematical procedures and deeper conceptual understanding inherent in the CCSS.	*The lesson/unit reflects evidence of key shifts that are reflected in the CCSS:* o **Focus:** Lessons and units targeting the major work of the grade provide an especially in-depth treatment, with especially high expectations. Lessons and units targeting supporting work of the grade have visible connection to the major work of the grade and are sufficiently brief. Lessons and units do not hold students responsible for material from later grades. o **Coherence:** The content develops through reasoning about the new concepts on the basis of previous understandings. Where appropriate, provides opportunities for students to connect knowledge and skills within or across clusters, domains and learning progressions. o **Rigor:** Requires students to engage with and demonstrate challenging mathematics with appropriate balance among the following: – **Application:** Provides opportunities for students to independently apply mathematical concepts in real-world situations and solve challenging problems with persistence, choosing and applying an appropriate model or strategy to new situations. – **Conceptual Understanding:** Develops students' conceptual understanding through tasks, brief problems, questions, multiple representations and opportunities for students to write and speak about their understanding. – **Procedural Skill and Fluency:** Expects, supports and provides guidelines for procedural skill and fluency with core calculations and mathematical procedures (when called for in the standards for the grade) to be performed quickly and accurately.	*The lesson/unit is responsive to varied student learning needs:* o Includes clear and sufficient guidance to support teaching and learning of the targeted standards, including, when appropriate, the use of technology and media. o Uses and encourages precise and accurate mathematics, academic language, terminology and concrete or abstract representations (e.g., pictures, symbols, expressions, equations, graphics, models) in the discipline. o Engages students in productive struggle through relevant, thought-provoking questions, problems and tasks that stimulate interest and elicit mathematical thinking. o Addresses instructional expectations and is easy to understand and use. o Provides appropriate level and type of scaffolding, differentiation, intervention and support for a broad range of learners. – Supports diverse cultural and linguistic backgrounds, interests and styles. – Provides extra supports for students working below grade level. – Provides extensions for students with high interest or working above grade level. *A unit or longer lesson should:* o Recommend and facilitate a mix of instructional approaches for a variety of learners such as using multiple representations (e.g., including models, using a range of questions, checking for understanding, flexible grouping, pair-share). o Gradually remove supports, requiring students to demonstrate their mathematical understanding independently. o Demonstrate an effective sequence and a progression of learning where the concepts or skills advance and deepen over time. o Expect, support and provide guidelines for procedural skill and fluency with core calculations and mathematical procedures (when called for in the standards for the grade) to be performed quickly and accurately.	*The lesson/unit regularly assesses whether students are mastering standards-based content and skills:* o Is designed to elicit direct, observable evidence of the degree to which a student can independently demonstrate the targeted CCSS. o Assesses student proficiency using methods that are accessible and unbiased, including the use of grade-level language in student prompts. o Includes aligned rubrics, answer keys and scoring guidelines that provide sufficient guidance for interpreting student performance. *A unit or longer lesson should:* o Use varied modes of curriculum-embedded assessments that may include pre-, formative, summative and self-assessment measures.
Rating: 3 2 1 0	Rating: 3 2 1 0	Rating: 3 2 1 0	Rating: 3 2 1 0

The EQuIP rubric is derived from the Tri-State Rubric and the collaborative development process led by Massachusetts, New York, and Rhode Island and facilitated by Achieve.
This version of the EQuIP rubric is current as of 06-15-13.
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COLLEGE AND CAREER READY STANDARDS

Equip Jigsaw

- At your table, discuss what the following terms/phrases mean for your section:
  - I. Alignment to the Depth of the CCSS
  - II. Key Shifts in the CCSS
  - III. Instructional Supports
  - IV. Assessment

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Our Process, continued…

- Develop aligned lessons
- Evaluate these lessons on the EQuIP rubric
- Revise the lesson
- Teach the lesson in multiple classrooms with multiple teachers (also obtain video, student work samples and teacher feedback)
- Revise the lesson
- Evaluate again on the EQuIP rubric
- Evaluate the video and student work for alignment

ARIZONA'S
COLLEGE AND CAREER READY STANDARDS

Cluster(s): Develop understanding of fractions as numbers.

Standard Code	Standard Description
3.NF.1	Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.

Connected Standard Code	Standard Description
3.G.2	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.

MP Code	MP Description	Associated Task
3.MP.1	Make sense of problems and persevere in solving them.	see lesson plans
3.MP.4	Model with mathematics.	see lesson plans
3.MP.6	Attend to precision.	see lesson plans
3.MP.7	Look for and make use of structure.	see lesson plans

Lesson # 1 (SO1 and 2) **Estimated Length of Lesson: 45-60 minutes**

Common Core Standards: 3NF1 – Unit Fractions - Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b.

Mathematical Practices: 1, 4

Lesson Outcome: The students will divide a shape into fractional parts (halves, thirds, fourths, sixths, and eighths).

Academic Vocabulary: fraction, equal-sized parts, whole, halves, thirds, fourths, sixths, and eighths

Possible Misconceptions/Suggestions:

Possible Misconceptions	Suggestions
Fractions random-sized parts of a whole	Model clearly with manipulatives and visuals.
Students think they can cut a circle into equal parts in the same way they can cut a rectangle or square:  	Using a paper model, cut out the uneven sixths created on the circle and lay them on top of each other to show they are unequal.

Foundational Skills-2.G.A.3

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Table Talk

- How did the student's explanation help clarify a possible misconception?

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Student will determine the number of equal parts needed to make a whole (start with halves, progress to fourths, then eighths).	Teacher guides class exploration. Each student has a set of four equal length strips of paper in different colors. Hold up your blue strip of paper. This is your whole. Label it '1 whole.' Hold up your red strip of paper. How can we fold this strip of paper into two equal parts? What do I call each of these parts? Repeat for fourths and eighths, each with a different colored strip of paper.	Students will fold red strip of paper into two equal parts and label each part with a word and a fraction.	Peer-to-peer checks, teacher observes and monitors, clarifying as needed. Teacher clarifies that shape is divided into two equal parts and each part is called 'one half' and the whole shape is folded into 'two halves.' Repeat with fourths, eighths to ensure students have been exposed to the vocabulary while connecting it to concrete model.

Questioning:

Probing	Assessing	Extending
What is a fraction? What is not a fraction? How many _____(halves, thirds, fourths, sixths, eighths) does it take to make a whole strip?	Is this a fraction? Why or why not? Is your strip folded into equal parts? How do you know?	What relationships did you discover about the fractions? What other examples can you use to show fractions (halves, fourths, etc)? If you made a 1/9 strip, how many ninths would you need to make a whole?

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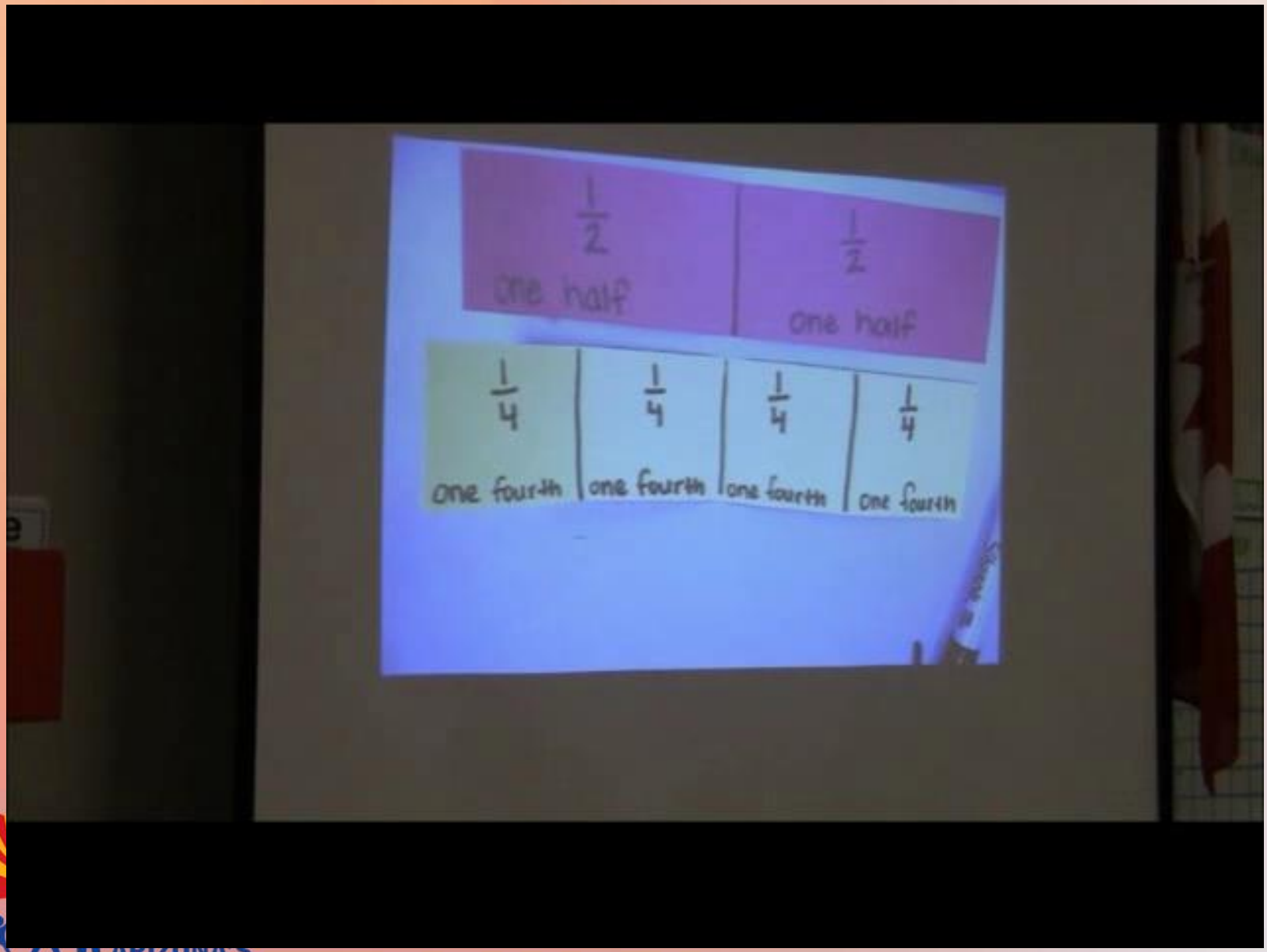
1/2
one half
1/2
one half
1/4
one fourth
1/4
one fourth
1/4
one fourth
1/4
one fourth

Table Talk

How is ***productive struggle*** utilized in the video as an instructional tool?

What are the benefits in doing this?

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Students will divide and label a rectangle into various fractional parts.	Teacher will distribute "Dividing Rectangles" sheet to students.	Students will complete tasks and questions on "Dividing Rectangles" sheet.	Teacher will assess students' ability to: -create equal-sized parts of a whole as prompted -reflect on conceptual understanding of fractions

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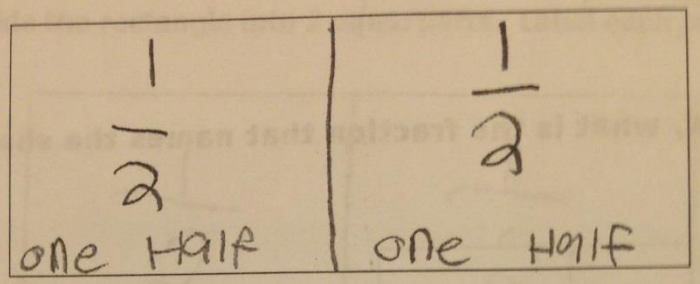
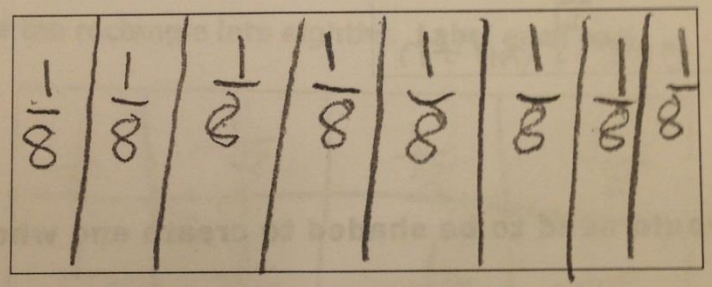
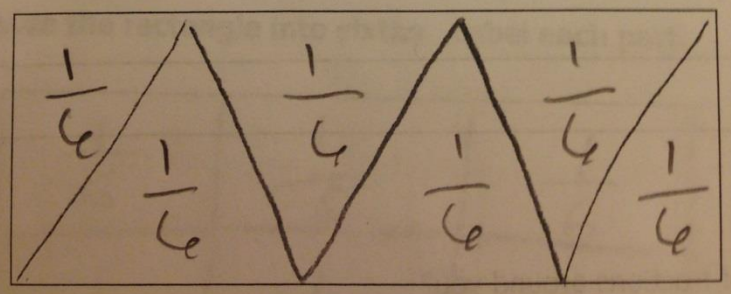
1. Divide the rectangle into 2 equal parts. Label each part.



2. Divide the rectangle into eighths. Label each part.



3. Divide the rectangle into sixths. Label each part.



EVOLUTION OF REFLECTION AND REVISION

"The quality of mental process, not the production of correct answers, is the measure of educative growth."

~ John Dewey

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Questions

- What am I learning?
- Why am I learning this?
- How will I use this?
- How aware are my students aware of the thinking processes they engage in during class time?
- How can I scaffold the metacognitive experiences for them?

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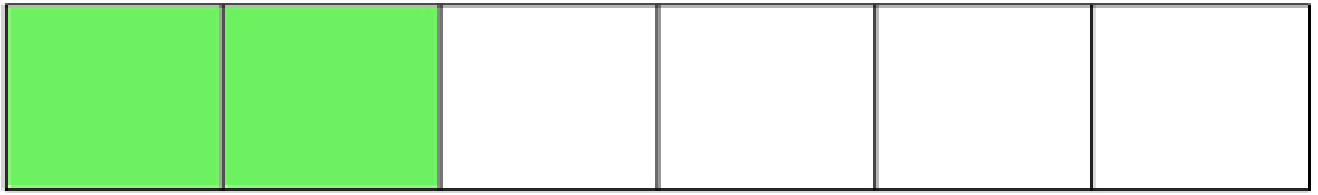
Student Evidence

Illustrative Mathematics

3.NF Naming the Whole for a Fraction

Mrs. Frances drew a picture on the board.



Then she asked her students what fraction it represents.

- Emily said that the picture represents $\frac{2}{6}$. Label the picture to show how Emily's answer can be correct.
- Raj said that the picture represents $\frac{2}{3}$. Label the picture to show how Raj's answer can be correct.
- Alejandra said that the picture represents 2. Label the picture to show how Alejandra's answer can be correct.

Scoring Guide

____ Student uses specific language (MP 6 – attend to precision) in order to clarify the ambiguity presented in the task e.g. label the whole, shaded part, unshaded part etc.

____ Student interprets the fractions as representing the shaded OR unshaded portion

_____Student uses pictures, numbers and words to demonstrate understanding and explain mathematical reasoning

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Scoring Guide

Student Evidence of Mathematical Practices

MP1 Make sense of problems and persevere in solving them

Students:

- explain what the problem means
- identify an entry to the problem/solution
- analyze scope of the problem based on given information
- plan a solution pathway

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John Dewey

"We do not learn from experience . . . We learn from reflecting on experience."

Writing and Math

Math Reflection Student Checklist

- ❑ Does my reflection contain at least one MP that is correctly identified with the correct number?
- ❑ Does my reflection include a brief definition/explanation of the MP(s)?
- ❑ Does my reflection include a description of the context (task/activity/problem/concept) in which the MP was used?
- ❑ Does my reflection include an explanation of how the MP relates the context/task/activity/problem/concept?
- ❑ Does my reflection include insight into the connections I made mathematically?
- ❑ Does my reflection include additional examples and explanations and/or connections to the real world?
- ❑ Does my reflection include pictures/symbols/numbers/real-world examples?
- ❑ Is my reflection well organized with a logical development and structure (clear beginning, middle, end)?

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5 Number Puzzles WP

First, I entered the problem. I counted by 15 up to 150. Then I counted by 25. I had two numbers after that 75 and 150. After that I looked at the clue and it says "I am an even number" so then I realized that I found the answer. 150 was my number. That is how I figured out 150 was the answer.

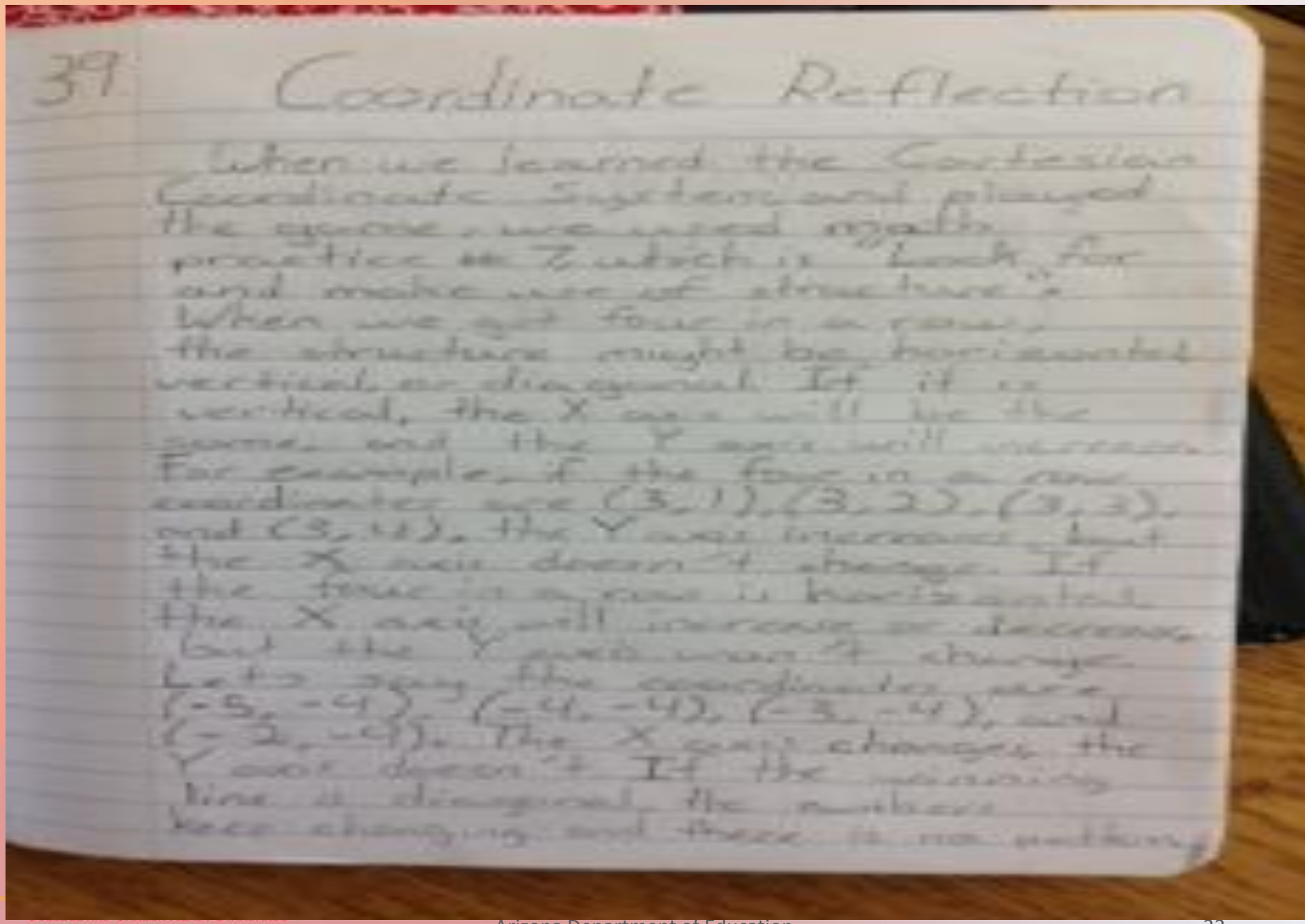
I think I modled with mathematics. I think that because I showed my thinking and showed how I solved the problems.

count by 15

15 30 45 60 75 90 105 120 135 150

count by 25

25 50 75 100 125 150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Coordinate Reflection

When we learned the Cartesian Coordinate System and played the game, we used mjath practice ## 2 which is "Look for and make use of structure." When we got four in a row, the structure might be horizontal, vertical, or diagonal. If it is vertical, the X axis will be the same and the Y axis will increase. For example, if the four in a row coordinates are (3, 1), (3, 2), (3, 3), and (3, 4), the Y axis increases, but the X axis doesn't change. If the four in a row is horizontal, the X axis will increase or decrease, but the Y axis won't change. Let's say the coordinates are (-5, -4), (-4, -4), (-3, -4), and (-2, -4). The X axis changes, the Y axis doesn't. If the winning line is diagonal, the numbers have changing and there is no pattern.

Challenges encountered

- Required both horizontal and vertical alignment
- Common language was needed among all participants
- Participants had to be able to articulate clearly
- Background knowledge in content cannot be assumed

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Benefits

- Constant and consistent reflection and revision
- Became quite evident that teaching is no longer a checklist
- Learn to articulate ideas and thoughts

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Next Steps

- Learn about repeating this process
- Utilize this work to help facilitate the process in my school
- Copies of slide show frankie.sullivan@azed.gov

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Thank You!